Lucent Technologies
Bell Labs Innovations

The Lucent *Packet*IN™ Solutions

Extending the Capabilities of Today's Circuit and Packet Networks

Why *Packet*IN Solutions? Why Now?

Successful networks must blend voice, data, and video into a seamlessly networked flow of information over public and private networks. In the first years of the new millenium, not only is this trend expected to continue, it's expected to explode!

Packet-based data network products hold the promise of faster speeds, greater access, more bandwidth, and lower costs. At the same time, the pervasiveness of both the Internet and phone services offers new combined voice/data service opportunities that link easy-to-use browser interfaces to the revenue-generating voice service market. This combination offers the opportunity to attract customers with unique service offerings, interconnect with other networks for service delivery, and respond quickly to end-user service requests.



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Lucent Intelligent Networks

End to End Solutions™

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Carriers and service providers are already rapidly deploying next-generation packet network technologies, but they need more than potential cost savings. They expect to benefit from the rapid service innovation that is coming out of the Internet. In response, the Lucent *Packet*IN Solutions give carriers an infrastructure for offering new Internet Protocol (IP) services while still bridging into their existing added-value services.

While the ability to offer new or next-generation services is important, both the carriers who already have an Intelligent Network (IN) and those who are new entrants need to provide service parity with circuit networks. To compete, both groups need to offer enhanced voice services (such as Call Waiting, Calling Name, Voice Virtual Private Network, Advanced Toll-Free, and Flexible Network Routing), as well as the capability to transport voice over data networks. For incumbent carriers, this means protecting their Intelligent Network (IN) infrastructure investment with a graceful transition to packet network solutions that take advantage of existing infrastructure and services. For new entrants, this means obtaining a cost-effective way to enter the market; one that helps them compete on a feature-by-feature basis with incumbents, but doesn't require purchasing a service control point (SCP). Our *Packet*IN Solutions meet the needs of both incumbents and new entrants.

While carriers and service providers recognize the need to deliver IP-based services, they have a number of challenges to overcome:

- Solutions need to work for both the PSTN and data networks.
- There are many vendors and many different protocols. Providers need the ability to interoperate packet circuit gateways (PCGs) from many vendors using different protocols.
- Incumbents, who have already invested in IN services, need the capability of extending these services across data networks as well as offering new Internet-based services. New entrants need a way to enter the market on a level playing field — that is, offering service parity — without having to invest in an IN infrastructure.
- Carriers also need a solution that helps them manage converged network scalability.

Lucent is working to meet the needs of carriers and service providers by making services and platform enhancements that leverage packet-based networks. The result? The Lucent *Packet*IN Solutions. These solutions feature the *Packet*IN Applications Server, which enables carriers to deliver a wide variety of enhanced wireline or wireless services for voice and data networks and introduces a suite of new Internet/IP services.

Typically, applications servers host services on the Internet. These servers host web content and execute e-commerce functions. To enable the convergence of voice and data services, Lucent is offering a solution where we add the voice service protocols, which are the foundation of the PSTN's intelligent network, to commercial application services. It is this converged applications server platform that we use to offer *Packet*IN services. The P*acket*IN Solutions' software architecture is based on the Lucent Softswitch platform — a programmable, multi-protocol software system that enables network interoperability and rapid service deployment. As illustrated in Figure 1, the Lucent Softswitch platform has been welcomed by industry analysts.

The *Packet*IN Solutions also offer integrated service creation and service management across circuit and packet platforms. By integrating key technologies from the softswitch engine and the *Packet*IN Applications Server with our existing services portfolio, Lucent gives carriers and service providers the power to move at "Internet speed" to deploy next-generation services.



Broadband Networking News

SOFTSWITCH GIVES VOIP CREDIBILITY

"Softswitch puts forward a potentially compelling proposition to IP-based carriers..."

Inter@ctiveWeek – July2, 1999

Not Just Another Deal

"... But there is only one groundbreaking design and the Level 3/Lucent contract is it."

"One of the things that is significant about this deal is that it shows the Lucent has figured out a way to sell software."

– Hilary Mine, Probe Research, June 28, 1999

Figure 1. Lucent Softswitch Press Quotes

The Changing Marketplace

Global changes in the communication market are causing the convergence of technology and the separation of the value chain into distinctly different business models. The emerging business architectures and models depend on the promises of packet-switched ubiquitous interconnection, inexpensive bandwidth, and distributed intelligence. The solution for carriers and service providers lies in innovations that enable new forms of business and integrate media services.

The Lucent *Packet*IN Solutions' architecture provides for new economic and business models based on its distributed, highly scalable *Packet*IN Applications Server. Further, this breakthrough software platform works with multiple vendors' equipment, multiple protocols, and many network infrastructures (e.g., IN, trunking, and packet implementations) to enable services across both PSTN and data networks. It offers rich services by interworking with existing networks, such as the PSTN and the Internet, and through the use of open application programming interfaces (APIs).

What Are the *Packet*IN Solutions?

The Lucent *Packet*IN Solutions are a family of advanced services and software platforms that enable the creation and delivery of enhanced services on a hybrid voice/data network. Lucent offers IP-based Internet services that bridge the PSTN and IP domains, services for voice over IP and asynchronous transfer mode (ATM), and new services for next-generation IP networks, as shown in Figure 2.

Our *Packet*IN Solutions make use of Lucent's breakthrough software switch technology (the Lucent Softswitch), which allows PSTN and data networks to interoperate. Lucent has one of the most robust portfolios of enhanced services today, and we're entering the next-generation IP arena with additional services and building blocks. Our portfolio supports multiple network topologies and carrier evolution strategies. Further, the *Packet*IN Solutions offer integrated service management and a common service creation environment.

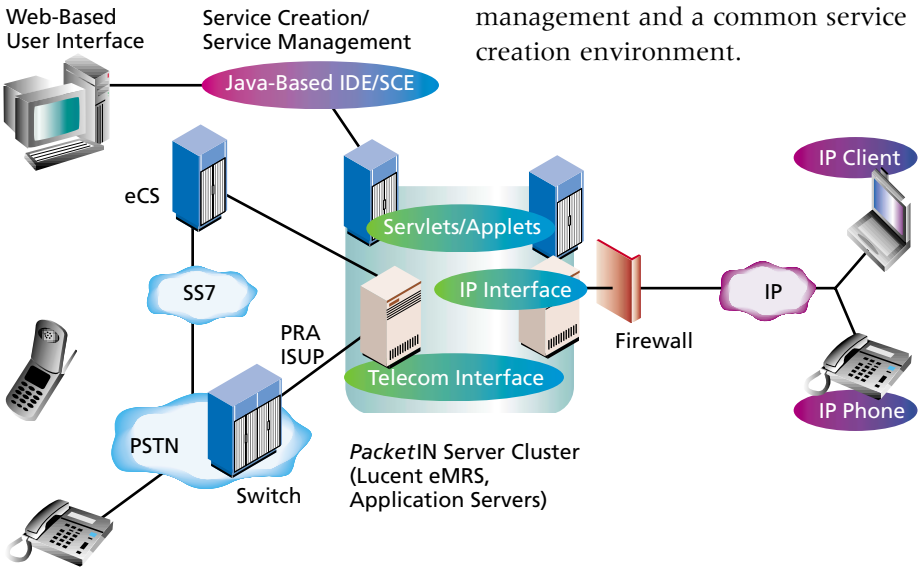

*Figure 2. Packet*IN *Solutions Architecture*

A Comprehensive Strategy for *Packet*IN Services

Lucent's strategy for its *Packet*IN services consists of the following three-pronged approach:

- To facilitate the creation of innovative services.
- To build a repository of service building blocks or components and service-enabling technologies.
- To develop a number of "off-the-shelf" applications.

To help facilitate the creation of new innovative services, Lucent is offering rapid prototyping tools and teams. Lucent is making these tools and a team of dedicated developer resources available to collaborate with carriers to facilitate the exchange of ideas and the prototyping of potential services. These rapid prototyping tools are available to both Lucent developers and carrier development teams in order to facilitate the development of services. In addition, independent software vendors (ISVs) can gain access to these tools through the Lucent Full Circle program (http://www.lucent.com/gsp/full_circle/), which provides Lucent support, training, interoperability testing, and application certification to Lucent certified ISVs.

To provide the maximum reuse of services, Lucent is building a repository that contains a core set of components, or building blocks, that can be combined quickly for new offers and for rapid prototyping of services in conjunction with carrier partners. These building blocks provide the capabilities that are used by many applications, such as billing and system management, call routing, and other frequently used functions.

The third prong of Lucent's strategy involves the development of "off-the-shelf" applications. These services are generally available as fully functional *End to End Solutions* that carriers can purchase and implement without additional development on their part. These solutions fall into the following categories:

- **IN-based Internet Services** — These offers are a good fit for carriers and service providers who are using data networks to extend the service capabilities of their existing circuit-switched networks. New services include our Online Communications Center, the *TelePortal*™ Solution, and wireless data services.
- **IN Services for VoIP/ATM Networks** — These offers are a good fit for carriers and service providers who are transporting voice over their data networks in order to lower infrastructure costs, or for new entrants, who need to offer parity with existing voice networks. They include services such as Number Portability, Advanced Toll-Free, and Voice Virtual Private Networks (VVPN) for voice over data networks.
- **Services for NextGen Networks** — These offers are a good fit for carriers and service providers who want to expand their service sets to include new data services or for new entrants who want to offer next-generation applications. An example is the combined voice/data Virtual Private Networks (VPNs).

Advantages of the Lucent *Packet*IN Solutions

When service providers and carriers choose the Lucent *Packet*IN Solutions, they gain these advantages:

- **Expertise** — Lucent has a long history of successfully providing value-added services for carriers, giving them the opportunity to gain new revenue.
- **Industry-Leading Services** — Lucent established itself as is an industry leader by launching some of the market's first enhanced services for NextGen networks, including *TelePortal* service and Online Communications Center.
- **Innovation** — Lucent's breakthrough softswitch platform, which enables PSTN and data networks to interoperate, is a leading-edge solution in the industry. Lucent's software-controlled services authoring environment is based on softswitch middleware.

- **Open APIs** — Our *Packet*IN Applications Server offers open, standard APIs, which enable third-party application developers to develop new applications that work with our platform. Lucent provides a wide community of these developers with support for testing and interoperability certification. This results in a broad selection of applications.
- **Graceful Transition** — Lucent helps to bridge circuit and packet networks with a common service creation environment and integrated service management.

Benefits for Carriers

The Lucent *Packet*IN Solutions offer carriers and service providers these benefits:

- **New Revenue Potential** — The platform uses *Java*™ software-enabled APIs, which means Lucent can offer applications from ISVs. This gives next-generation telephone companies flexibility in adding new services, such as user-enabled conferencing. Carriers also have the ability to interwork with IN-based services, so they can offer advanced voice network services based on IN. New entrants can also offer the same advanced network services on the *Packet*IN Applications Server. Finally, since the *Packet*IN Solutions provide converged data and voice services, carriers can potentially offer new revenue-generating data services, rather than giving data services away, as they may have in the past.
- **Heterogeneous Multi-Vendor Environments** — Since our multi-vendor softswitch platform provides full interoperability across different network interfaces and different vendors' equipment, carriers and service providers (including CLECs and ISPs) can interoperate with other carriers across the globe, terminating traffic and selling services through new channels. Carriers can also communicate across disparate VoIP gateways.
- **Smooth Integration** — The reuse of existing directory and network databases enables new services to work with legacy databases, minimizing work and speeding service creation efforts.
- **Rapid Deployment** — Carriers and service providers can bring the latest services to market quickly across converged networks because features only have to be installed once. Plus, the *Packet*IN Applications Server uses standard Internet building blocks for services, such as *Java* beans, so providers can quickly benefit from new applications as they arise. Further, our *Packet*IN Applications Server lets carriers reuse existing circuit-switched services, providing the fastest way for carriers to offer essential voice services.
- **Easy Provisioning** — Because the platform is simple network management protocol (SNMP) enabled, carriers and service providers can manage their networks the same way they manage them today. Plus, the software is designed to support operations, administration, and maintenance (OA&M) provisioning via policy management.
- **Scalability** — Our *Packet*IN Applications Server lets carriers "grow as they go," with its fully scalable, distributed architecture. They can also add services incrementally, when they need them.
- **Growth Opportunities** — Acquisitions and partnerships can focus on business needs and markets rather than being sidetracked or derailed by equipment compatibility issues.
- **Equipment Choices** — Businesses have a broader choice of new equipment because the platform helps make new purchases compatible with existing gear, resulting in maximum use of their network investments.

Benefits for End-Users

The Lucent *Packet*IN Solutions offer end-users these benefits:

- **New Services** — End-users benefit from new services, including access to web content from ordinary phones; Internet-based call control management; and web-based dialing, faxing, and teleconference management.
- **Additional Control** — Both business and residential customers gain additional control over phone calls, before the phone rings. A variety of calling services gives subscribers at a PC a choice of how to handle a call; they control how their calls are directed.
- **Ease-Of-Use** — With the visual interface provided by a PC, end-users can set up or make changes to services more easily than they can if they use the phone alone.
- **Reliable Service** — The *Packet*IN software provides fault tolerance for both the call coordinator and device servers, resulting in more completed calls and more reliable service for subscribers.

*Packet*IN Service Offerings

Carriers and service providers are installing packet networks for multiple purposes — to extend the service capabilities of their existing circuit-switched networks, to transport voice over the packet network, to create new services, or to expand existing services. These purposes can be characterized as IN-based Internet services, IN services for VoIP/ATM networks, and services for NextGen networks. *Packet*IN Solutions offer enhanced services and service infrastructure for each of these purposes. Figure 3 shows the typical architecture found in today's networks with today's services. As we discuss each *Packet*IN Solutions offering, subsequent architecture diagrams illustrate how the Lucent *Packet*IN Solutions build on current network infrastructure to offer new or enhanced services.

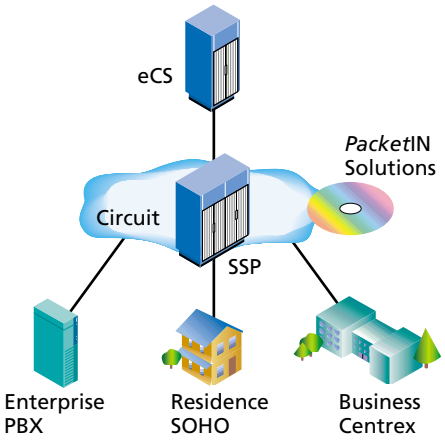

Figure 3. Today's Network with Today's Services

IN-based Internet Services

Perceptive carriers want to use the ubiquity of the Internet to make existing phone services better. These carriers recognize that next to every PC is a phone — and that PC, if it is connected to the Internet, can be used to assist phone calls. Compared with a regular touch tone phone or even an ISDN phone, the PC's visual interface is far more expressive. Using that interface can add value to telephone services by simplifying features that subscribers may already be using.

The Internet paradigm says that the network is programmable by end-users. That is, Internet users can post their own web content, create their own web services, and configure their own service policies. For example, today's subscribers can set up or change a personal profile using a web browser, which can make an existing service easier to use. Using a web-based interface to change numbers in a personal number service greatly increases the usefulness of the service. Every service with parameters that can be changed by users or telecommunication managers can be improved via a web interface for easy provisioning. Likewise, in next generation networks, carriers need to offer the ability to let their subscribers program their own services.

The Lucent *Packet*IN Solutions provide those interfaces. Our *TelePortal* Solution is an example of a service that addresses this end-user programmability need. Figure 4 illustrates the interface between circuit and data networks, which enables carriers and service providers to offer new services on existing networks.

A growing number of subscribers want to manage their calls *before* the phone rings. Now they can. The *Packet*IN Applications Server detects the call and gives the subscriber, who is using a PC, a choice of how to handle the call. The subscriber can take the call (using VoIP), send it to voice mail, or forward it to another number. This capability is the basis of our residential and business *Packet*IN offer, the Online Communications Center (OCC).

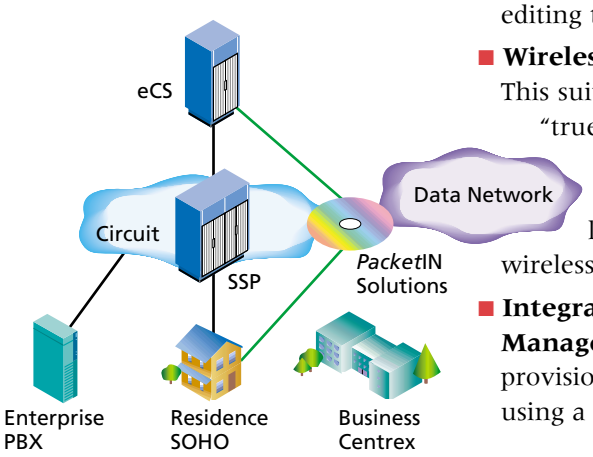

Figure 4. Architecture that Enables IN-Based Internet Services

IN-based Internet services include:

- **Online Communications Center (OCC)** — A total solution that allows users to control incoming and outgoing calls via the Internet. Residential users can use the OCC to receive telephone calls while online, extending the use of a single line. Business users can improve productivity by obtaining real-time information about incoming calls and using network intelligence to prioritize and redirect incoming calls based on Caller ID information.
- **The *TelePortal* Solution** — Using industry-standard voice extensible markup language (VoiceXML) technology, *TelePortal* is a service that hosts voice service logic on web pages. With *TelePortal* Solution, subscribers can change the behavior of their voice services using industry-standard web-page editing tools.
- **Wireless Data Services** — This suite of services provides "true mobility" by offering combined messaging, e-care, e-commerce, and location-based services to wireless subscribers.
- **Integrated Services Management** — the end-user provisioning of subscriber data using a web interface.

IN Services for VoIP/ATM Networks

The immense investment in the Internet has caused the voice-over-data network to become the "hot" technology trend. Voice over IP or ATM is viewed by many as the wave of the future — a disruptive technology that's squeezing out the traditional circuit-switched network. Carriers are already working to rapidly deploy this technology in their networks.

To be competitive, both new entrants and incumbent carriers need to start by offering the existing suite of voice services on their packet networks. IN services are a major part of that existing suite of "in demand" services. For example, new long distance carriers need to offer Advanced Toll-Free and Voice VPN services in order to win customers in the business market. New local carriers need regulatory features (such as Number Portability) and value-added features (such as Call Screening and Calling Name services) in order to win residential customers. A carrier has to decide whether to reinvent all these voice services or to reuse what has already been developed in the circuit-switched world for voice over its data network. Lucent believes that reusing existing circuit-switched services is the fastest and best way for carriers to offer these essential voice services.

For carriers who already offer Lucent IN services in their networks, the Lucent *Packet*IN platform facilitates access to these existing features, which reside on the Enhanced Control Server (eCS, formerly called the Lucent Service Control Point or SCP) – or use a service control point to the packet network world. Consequently, these carriers don't have to reinvest in this functionality as they move to a packet network model. Lucent is taking the IN services that are available for the circuit-switched world and transparently applying them to voice over data networks. This is possible because voice over data networks have an element that's equivalent to the service switching function. This element, known as a "soft SSP" or "feature server," has the triggers and operations that the IN services require. Thus, all the services written for a service switching point/service control point (SSP/SCP) framework can work in a voice over data network. Figure 5 shows the architecture for delivering existing services on new networks.

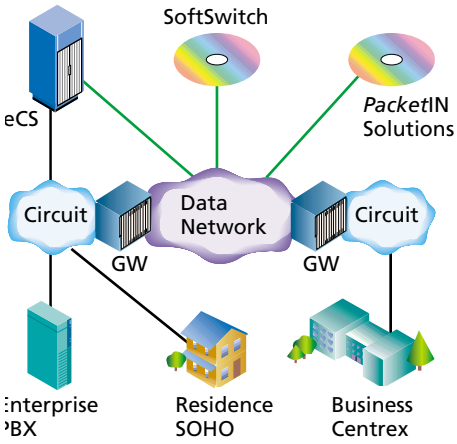

Figure 5. Architecture that Enables IN Services for VoIP/ATM Networks

But Lucent doesn't stop with its legacy IN customer base. There are many new entrants in this market who are looking to compete with the incumbent carriers. To attract customers away from the incumbents, these new entrants need to provide continued access to the services that end-users expect. With its *Packet*IN Solutions, Lucent gives new entrants the ability to compete head-to-head with incumbents. With the Lucent *Packet*IN Applications Server based on softswitch technology, new entrants can offer an equivalent set of IN features without investing in an SCP. Popular IN- and Advanced Intelligent Network (AIN)-based services have been ported to or developed on the platform, giving next-generation carriers a cost-effective solution to service parity.

In North America, IN Services for VoIP/ATM Networks can be considered as local and long distance services for carriers.

The Lucent *Packet*IN Solutions include the following services for VoIP and VoATM networks:

- **Advanced Toll-Free Service and Advanced Routing Services** — lets subscribers determine the treatment of calls based on various criteria, such as the geographic location of the caller, time-of-day and day-of-week, call media type (voice or data), and the caller's response to prompts. It uses subscriber-specific data to tell the switch how to route and charge a call.
- **Call Screening** — lets subscribers automatically screen incoming calls based on who the caller is, and allows the subscriber to set up personalized screening lists.
- **Caller ID and Calling Name** — lets subscribers screen incoming calls by reading the name of the calling party on a telephone display, adjunct device, or PC screen. PC users can get this functionality via the OCC offer.
- **Number Portability** — enables subscribers to retain their directory phone number when switching local carriers and/or when changing location within the same rate center.

- **Virtual Private Network** — offers businesses the advantages of private networks without the associated costs. The merging of voice and data VPN offers provides more efficient use of VPN networks. This convergence to a single VPN simplifies network management. It also simplifies end-user billing by providing users with a single bill for both voice and data services.

Services for NextGen Networks

Once carriers have invested in a large data network, they want to offer services beyond the existing voice services. This is true for both wireline carriers with standard data networks and wireless carriers with GSM packet radio services (GPRS) and third-generation (3G) systems. These carriers fear that all network intelligence will move to the edge, and their substantial data network investment will end up being nothing more than a "dumb pipe." Providing data-pipes is a commodity business with low margins; carriers need to offer unique value within their networks if they are to maintain margins and revenue. Providing value beyond just the pipes in a data network is where Lucent's services for NextGen networks can help. Figure 6 illustrates the architecture that enables carriers to offer these new services.

The framework to provide these new services is based on policy networks. A policy network, in its simplest form, uses rules (policies) that control elements in a data network. The language of the network is conveyed via policy enforcement and decision points. These points are currently associated with quality of service in routers, but in many ways, they function like SSPs and SCPs in today's IN architecture. Offering new services in these new networks requires fitting into this new data network policy paradigm.

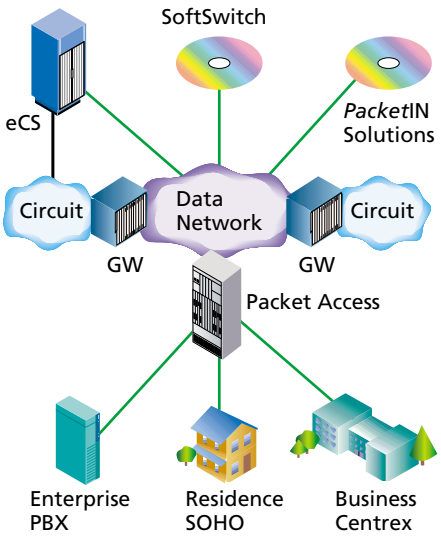

Figure 6. Architecture that Enables Services for NextGen Networks

- **Enhanced Services Authoring Environment (eSAE)** — A *Java* software-based service-creation environment that uses open, standard APIs for developing integrated voice and data services.
- **Calling Card Services for *Packet*IN Solutions** — offers popular billing services, such as disposable prepaid cards, rechargeable debit accounts, and credit accounts directly on your packet-based network. These card services give next-generation carriers a choice of ways to manage and administer prepaid and postpaid calling. This solution not only gives you the tools to manage your own brands and customers, but also provides tools for hosting these services for resellers, enabling them to remotely manage their own offerings.
- **Network Contact Center** — A NextGen solution that provides an all-media call center capability. This service seamlessly blends telephone calls and live, web-based multimedia Internet sessions.

Key *Packet*IN Differentiators

The Lucent *Packet*IN Solutions offer carriers the following key differentiators:

- **Enhanced Services Authoring Environment (eSAE)** — This *Java* software-based service-creation environment offers open, standard APIs for developing integrated voice and data services. This environment enables vendors, carriers, and third parties to develop, test, and modify voice and data services in a rapid, flexible manner. This environment uses *Java* bean technology to help ensure that service logic is portable and reusable, services are technology independent and provide support for multi-vendor servers, and the service environment facilitates end-user service creation and customization.
- **Enhanced Services Manager (eSM)** — This function helps service providers to manage multiple, advanced services on Enhanced Control Servers (eCSs) and Enhanced Media Resource Servers (eMRSs) from a single, seamless location. It provides wireline and wireless service providers the opportunity to increase their system throughput and capability, and help reduce their service provisioning costs, and improve time to market for new, complex services. In addition, it allows for a flexible, standard provisioning interface and a cost-effective means for setting security controls and managing capacity.
- **Rapid Prototyping** — This initiative partners customers and Lucent in the development of new services. It includes collectively brainstorming ideas, creating a prototype of the new service, and conducting a market trial of the service.
- **Hardware Independence** — The use of open, standard APIs and *Java* bean technology helps ensure that our *Packet*IN services are hardware independent and provide multi-vendor application server support.
- **Leverage of Middleware** — The *Packet*IN Solutions leverages the softswitch technology and middleware components that provide the open platform infrastructure to develop and deploy services.
- **Extensive ISV Program** — The Lucent Full Circle program offers extensive support to Lucent certified ISVs to make it easier for them to develop applications for the *Packet*IN platform. This program facilitates the development of a variety of applications from which carriers can choose.

Why Choose Lucent?

The Lucent *Packet*IN Solutions embody the innovation of Lucent Technologies' research and development arm, Bell Laboratories. The *Packet*IN Solutions not only take advantage of our breakthrough software switch technology, but they also give carriers and service providers access to one of the most robust portfolios of enhanced services available today. These services bridge the PSTN and IP domains and provide the building blocks for next-generation applications. The *Packet*IN Solutions support multiple network topologies and carrier evolution strategies as well as supporting today's major protocols and standards. And it doesn't stop there. Lucent is working to protect the ongoing value of carriers' network investments with platforms that are both compatible with existing systems and forward looking in their ability to migrate to the 3G network architecture of the future.

Lucent's experience and reputation are also a key advantage. Lucent Technologies supports customers and networks everyday, in more than 90 countries. Our extensive resume and broad portfolio of services is one of the best in the industry, with tremendous breadth and depth. Behind our skilled and experienced people is the knowledge and experience of Bell Laboratories. Renowned around the world for quality and innovation, Bell Labs continues to provide new ideas to meet both today's and tomorrow's market challenges. Lucent Technologies has a global reputation for supporting carriers with high-quality products and services. Our *Packet*IN Solutions are yet another contribution, helping extend the capabilities of today's circuit and packet networks.

Acronyms

3G – Third Generation
API – Application Programming Interface
ATM – Asynchronous Transfer Mode
CLEC – Competitive Local Exchange Carrier
COPS – Common Open Policy Service
eCS – Enhanced Control Server
eMRS – Enhanced Media Resource Server
eSAE – Enhanced Services Authoring Environment
eSM – Enhanced Services Manager
GPRS – GSM Packet Radio Service
GSM – Global System for Mobile Communication
GTT – Global Title Translation
GW – Gateway
HTTP – Hypertext Transfer Protocol
ID – Identification
IETF – Internet Engineering Task Force
IN – Intelligent Network
IP – Internet Protocol
ISDN – Integrated Services Digital Network
ISP – Internet Service Provider
ISV – Independent Software Vendor
IVCC – Internet Virtual Call Center
IVR – Interactive Voice Response
JAIN – *Java* APIs for Intelligent Network Services
LAN – Local Area Network
LDAP – Lightweight Directory Access Protocol
MSC – Mobile Switching Center
NW – Network
OA&M – Operations, Administration, and Maintenance
OCC – Online Communications Center
PBX – Private Branch Exchange
PC – Personal Computer
PCG – Packet Circuit Gateway
PDA – Personal Digital Assistant
PINT – PSTN Internet Interworking
POTS – Plain Old Telephone Service
PSTN – Public Switched Telephone Network
RADIUS – Remote Authentication Dial-In User Service
SAC – Service Access Code
SCP – Service Control Point
SIP – Session Initiation Protocol
SMPP – Short Message Peer-to-Peer Protocol
SNMP – Simple Network Management Protocol
SOHO – Small Office, Home Office
SS7 – Signal System 7
SSP – Service Switching Point
TAP – Telelocator Alphanumeric Protocol
TCAP – Transaction Capabilities Application Part
TCP – Transmission Control Protocol
URL – Universal Resource Locator
VoATM – Voice over Asynchronous Transfer Mode
VoiceXML – Voice Extensible Markup Language
VoIP – Voice over Internet Protocol
VPN – Virtual Private Network
VVPN – Voice Virtual Private Network
WWW – World Wide Web

For additional information, please contact your Lucent Technologies Sales Representative. You can also visit our Web site at http://www.lucent.com/software or call the following Lucent Technologies Response Centers:

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